Final Draft

ATTACHMENT 8
ROG Emissions
Agricultural Pesticide Application
San Joaquin Valley

Revised May 20, 2003

EMISSION INVENTORY SOURCE CATEGORY
Solvent Evaporation/Pesticides and Fertilizer

EMISSION INVENTORY CODES (CES CODES) AND DESCRIPTION
530-530-322-50000 (83550) Agricultural Pesticides – Methyl Bromide

530-530-570-20000 (83568) Agricultural Pesticides – Non-Methyl Bromide

METHOD FOR CALCULATING EMISSIONS

Historical Emissions

Emissions in this source category come from the application of agricultural pesticides and are estimated by the Department of Pesticide Regulation (DPR). By law, farmers and crop growers file daily and monthly, field-specific and product-specific pesticide use reports (PUR) with DPR. Subsequently, DPR uses all applicable data from the PUR to estimate total organic gas (TOG) emissions. Not all gases react in the atmosphere to form ozone and the subset of TOG that do react are called reactive organic gases or ROG. DPR develops TOG and ROG emission estimates on an annual basis for those years for which PUR data are available (1990-2001).

To calculate TOG emissions, DPR applies measured or assigned emission potentials (EPs) to the applicable PUR data. The measured EPs for any pesticide formulation are derived from experimental data obtained by thermogravimetric analysis. Most measurements for the EPs occurred between 1994 and 1999. For those pesticide formulation classes where experimental data are unavailable, DPR assigns default values (EPs), using scientific judgement considering the chemical and physical principles involved.

In 2002, DPR revised their methodology for assigning default EPs and also corrected some other shortcomings in their historical emission inventory. A detailed discussion of the basis for these changes is contained in a December 16, 2002 memorandum from DPR. The revised methodology results in significantly lower pesticide emissions than previously estimated, especially for the year 1990.

Forecasted Emissions

On an annual basis, DPR creates a database of monthly and annual base-year TOG emissions, which they then provide to the Air Resources Board (ARB). The ARB then estimates historical ROG emissions by applying a single speciation profile to the TOG

data provided by the DPR. The ARB also forecasts future year ROG pesticide emissions using the California Emission Forecasting System (CEFS), a sophisticated computer model.

Methodology

For most categories of the emission inventory, ARB uses CEFS to forecast future year emissions based on a single "base year" and appropriate temporal, growth, and control assumptions. In the case of State Implementation Plans (SIPs), the base year to be used for SIP future year forecasts is identified and agreed upon as part of the SIP planning process. For the upcoming San Joaquin Valley SIP, the agreed upon CEFS base year is 1999.

For agricultural pesticides, we recognize that forecasting future year emissions from a single base year (e.g. 1999) will not capture the recent (1999-2001) decline in agricultural pesticide emissions, as well as the inherent variability in pesticide emissions due to weather and pest infestations. We therefore forecast agricultural pesticide emissions from an "adjusted base year" that reflects the average of the emissions for a five year period – the base year itself, as well as two years on either side of the base year. In the case of the SJV SIP, emissions for the years 1997 through 2001 would be averaged and that number applied to the year 1999 for agricultural pesticide forecasting purposes. ARB and DPR staff agree that the use of this five year average is the most technically defensible approach currently available to account for the weather and pest related variability in agricultural pesticide emissions.

Temporal Profiles

For modeling and planning purposes, it is important to know how emissions occur temporally (i.e. by month of the year, time of the day). For example, for the SJV ozone SIP, we are concerned only about those pesticide emissions that occur during the summer ozone season (assumed to be May through October). DPR's monthly emissions data allow us to develop accurate monthly temporal profiles for each county in the SJV on a yearly basis. Similar to the forecasting methodology described above, the temporal profile is calculated using a five year average to account for weather and pest infestation variability. Table 1 shows the 1999 monthly temporal profile which reflects the average of DPR's 1997-2001 monthly ROG emissions. Based on this information, we assume 49% of the ROG emissions from agricultural pesticides in the SJV occur in the summer ozone season, while 51% occur in the winter season. For the agricultural pesticide daily and weekly temporal profiles, we currently assume agricultural pesticides are applied between the hours of 7:00 a.m. and 6:00 p.m. seven days a week.

Table 1: Percent Distribution of Agricultural Pesticide ROG Emissions in the SJV by Month*

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
7.5	7.3	10.3	8.0	6.8	7.1	11.6	8.6	6.7	8.2	9.7	8.2	100.0

* based on the average of five years (1997-2001) of DPR monthly ROG data

Growth Assumptions

ARB uses growth surrogates in the California Emission Forecasting System (CEFS) to predict future year pesticide emissions based on the DPR-provided base year data. For most categories of the inventory, we use growth surrogates developed as a result of a 1998 ARB research contract with Pechan and Associates. However, we recognize that the default growth surrogates selected by Pechan for some of the agricultural categories, including pesticides, may not be appropriate. The default growth surrogate suggested by Pechan for agricultural pesticides is farm sector output ($). However, discussions with agricultural experts and DPR indicate that a more realistic surrogate is irrigated agricultural acreage.

After extensive analysis, ARB staff recommend that irrigated agricultural acreage projections from the Department of Water Resources (DWR), modified by two land retirement programs, be used as the growth surrogate for agricultural pesticides. The projected overall decline in the SJV irrigated agricultural acreage of –0.3% per year agrees with anecdotal evidence provided through discussions with county agricultural commissioners and other agricultural experts. A more detailed discussion of the basis for the use of this proposed growth surrogate for agricultural pesticides, as well as some of the other agricultural categories, is provided in the document entitled “Forecasting Air Pollution Emissions from Agricultural Operations in the San Joaquin Valley” dated May 20, 2003.

Control Assumptions

We explicitly account for the phase out of methyl bromide due to the Montreal Protocol. The Montreal Protocol requires developed countries, including the United States, to completely phase out methyl bromide use by the year 2005. However, certain applications and critical uses of methyl bromide are exempt from the Montreal Protocol. Based on discussions with DPR, we assume future year (2002 and beyond) emissions of agricultural methyl bromide will decline until the year 2010 when they will plateau at 1/3 the 1990 emissions of methyl bromide (to account for the continued use of methyl bromide for certain critical agricultural applications).

ROG EMISSIONS IN THE SAN JOAQUIN VALLEY

Table 2 and Figure 1 show the estimated summer ROG emissions from agricultural pesticides in the San Joaquin Valley for the years 1999 and 2010. The 1999 estimates reflect actual historical data provided by DPR. The 2010 estimates were developed by ARB using the CEFS model and the following assumptions:

a) a 1999 base year that is adjusted to account for weather and pest infestation variability by taking the average of five years of historical DPR data (1997-2001);
b) a 1999 monthly temporal profile that is adjusted to account for weather and pest

infestation variability by taking the average of five years of DPR's monthly ROG emissions (1997-2001);

c) a growth surrogate of irrigated agricultural acreage based on DWR and land retirement projections, corroborated by historical acreage declines and discussions with agricultural experts.

Table 2: Summer Agricultural Pesticide ROG Emissions in the SJV (tons per day)

Category	**1999**	**2010**
Agricultural Pesticides – Methyl Bromide	5.2	2.1
Agricultural Pesticides – Non-Methyl Bromide	21.3	20.9
TOTAL	**26.5**	**23.0****

* May – October

** Projected from adjusted 1999 base year of 25.8 tons per day

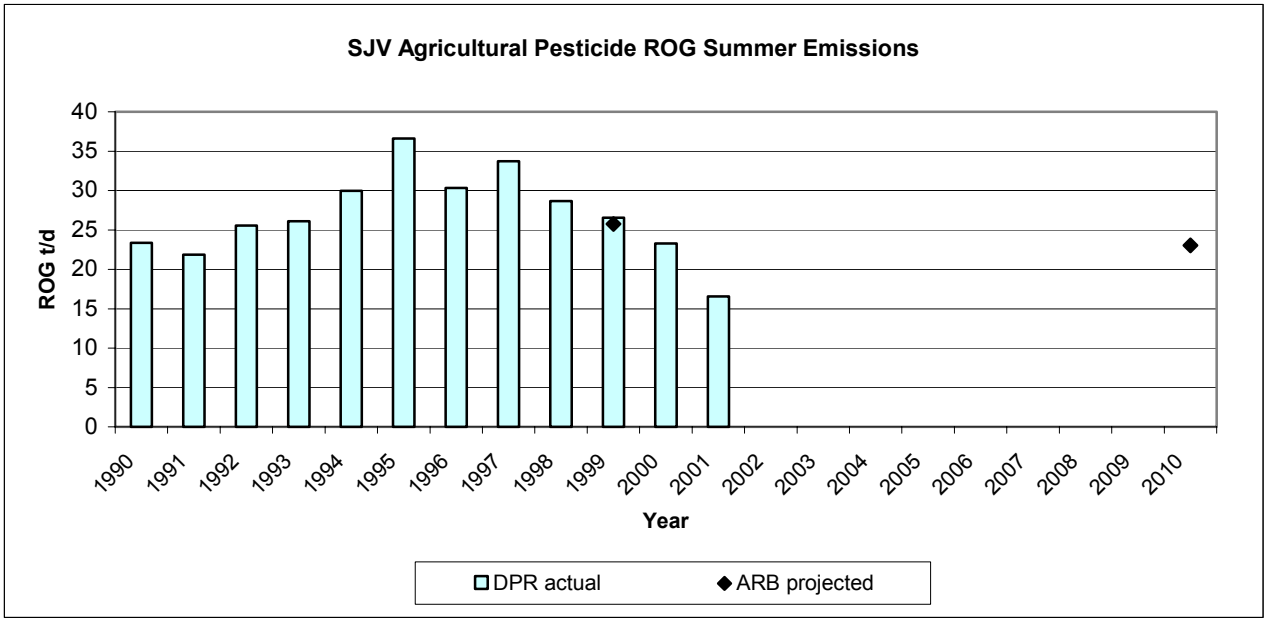

Figure 1: Historical and Projected SJV Summer Agricultural Pesticide ROG Emissions